



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/596,612	06/19/2006	Bartlomiej Jan Pawlak	NL031498	8409
65913	7590	12/09/2010	EXAMINER	
NXP, B.V. NXP INTELLECTUAL PROPERTY & LICENSING M/S41-SJ 1109 MCKAY DRIVE SAN JOSE, CA 95131			SENE, PAPE A	
			ART UNIT	PAPER NUMBER
			2812	
			NOTIFICATION DATE	DELIVERY MODE
			12/09/2010	ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ip.department.us@nxp.com

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/596,612	PAWLAK ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	PAPE SENE	2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 19 June 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                    | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)         | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Response to Arguments***

1. Applicant's arguments, with respect to the rejection of all the claims have been fully considered and, the argument with respect to claim 8 is persuasive. Examiner believes that the 103(a) rejection done to reject claim 8, was appropriate, since it can clearly be observed from the drawings that the first area thickness is 2 to 4 times the second area thickness. But based on arguments that such an observation does not occur, examiner withdraws the rejection of claim 8. However, upon further consideration, a new ground(s) of rejection is made. Examiner never stated that Wang does not disclose a second amorphous layer; what is not disclosed by Wang, is applying a first solid phase epitaxial regrowth action to partially regrow the first amorphous layer and form a second amorphous layer having a second depth less than the first depth and activate the first dopant. Examiner points out that Wang does indeed disclose a second amorphous layer 218 since 218 is formed in an amorphized region 208. Keys is brought in to teach a method used for obtaining an amorphous layer, the limitation of applying a first solid phase epitaxial regrowth to partially regrow the first amorphous layer and form a second amorphous layer. And using the method taught by Keys will yield to forming junctions that are shallow. Regarding the other arguments that examiner is just providing a mere statement and no specific reason for combining references, examiner disagrees, and points out that because a motivation for combining is well known, for example doping portions of a substrate with boron to form P-type

Art Unit: 2812

regions, it does not mean that it is a mere statement. Examiner believes that the motivations provided were proper ones.

### ***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims **1-5** are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (U.S. Patent Application Publication No. 2005/0054173) in view of Keys (U.S. Patent Application Publication No. 2004/0235280).

1. Referring to claim **1**, Wang discloses a method of producing a semiconductor device comprising: a) providing a semiconductor substrate (**200**, **fig. 2A**, **[0024]**), b) making a first amorphous layer (**208**) in a top layer of said semiconductor substrate (**200**) by a suitable implant (**206**), said first amorphous layer (**208**) having a first depth (**fig. 2B**, **[0026]**), c) implanting a first dopant (**212**) into said semiconductor substrate (**200**) to provide said first amorphous layer (**208**) with a first doping profile (**212**, **fig. 2C**, **[0027]**), d) form a second amorphous layer (**218**) having a second depth that is less than said first depth and activate said first dopant (**212**) (**218**, **fig. 2D**, **[0029]**, **wherein 218 depth is less than 208 depth**), e) implanting a second dopant (**216**) into said semiconductor

Art Unit: 2812

substrate **(200)** to provide said second amorphous layer **(218)** with a second doping profile with a higher doping concentration than said first doping profile **(218, fig. 2D, [0029])**, f) applying a second solid phase epitaxial regrowth action to regrow said second amorphous layer and activate said second dopant **(figs. 3 and 2E, [0031])**.

However, Wang does not specifically disclose applying a first solid phase epitaxial regrowth action to partially regrow said first amorphous layer and form a second amorphous layer and activate said first dopant.

Keys teaches c) implanting a first dopant into said semiconductor substrate to provide said first amorphous layer with a first doping profile **(207)** and d) applying a first solid phase epitaxial regrowth action to partially regrow said first amorphous layer **(202)** and activate said first dopant **(207) (fig. 4, 412(b), [0028]-[0030], wherein solid phase epitaxy regrowth is recrystallization by annealing)**.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made, to partially regrow the first amorphous layer, as taught by Keys, for the purpose of forming shallow junctions **([0025] and [0031], Keys)**

2. Referring to claim **2**, Wang and Keys disclose a method according to claim 1, and Wang further discloses that said semiconductor substrate **(200)** is a Si substrate **([0024])** and action b) is performed with at least one of Ge, GeF<sub>2</sub>, Si, Ar or Xe atoms **([0026])**.

3. Referring to claim **3**, Wang and Keys disclose a method according to claim 2, and Wang further discloses that said action b) is performed with Ge in a dose of  $10^{15}$  atoms/cm<sup>2</sup> and an energy between 2 and 30 keV **([0026])**.

4. Referring to claim **4**, Wang and Keys disclose a method according to claim 1, and Wang further discloses that said action c) is performed with at least one of B, P, As and In at an energy between 3 and 10 keV **([0027])**, and Keys further teaches that said action c) is performed with at least one of B, P, As and In at an energy between 3 and 10 keV, and a dose of  $10^{14}$  atoms/cm<sup>2</sup> **([0029])**.

5. Referring to claim **5**, Wang and Keys disclose a method according to claim 5, and Keys further teaches that action d) is performed at a temperature of 550-750 °C during a few seconds **([0027])**.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made, to modify the disclosure of Wang, and further include the teaching of Keys, for the same reason as above, with respect to claim 1.

4. Claim **6** is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (U.S. Patent Application Publication No. 2005/0054173) in view of Keys (U.S. Patent

Art Unit: 2812

Application Publication No. 2004/0235280) and in further view of Sultan (U.S. Patent No. 6,063,682).

6. Referring to claim **6**, Wang and Keys disclose a method according to claim 1, and Wang further discloses that said action e) is performed with at least one of B, P, As and a dose of  $10^{15}$  atoms/cm<sup>2</sup> **([0029])**.

However, Wang and Keys do not specifically disclose that action e) is performed with at least one of B, P, As and In at an energy between 0.5 and 3 keV, and a dose of  $10^{15}$  atoms/cm<sup>2</sup>.

Sultan teaches a method, wherein implanting a dopant into a semiconductor substrate to provide an amorphous layer with a doping profile is performed with at least one of B, P, As and In at an energy between 0.5 and 3 keV, and a dose of  $10^{15}$  atoms/cm<sup>2</sup> **(Col. 6, Ln. 24-26)**.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made, to perform action e) with at least one of B, P, As and In at an energy between 0.5 and 3 keV, and a dose of  $10^{15}$  atoms/cm<sup>2</sup>, as taught by Sultan, for the purpose of amorphizing the substrate **(Col. 6, Ln. 30, Sultan)**.

5. Claim **7** is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (U.S. Patent Application Publication No. 2005/0054173) in view of Keys (U.S. Patent Application Publication No. 2004/0235280) and in further view of Xiang (U.S. Patent No. 6,555,439).

7. Referring to claim **7**, Wang and Keys disclose a method according to claim 1, wherein prior to said action b), an initial dopant is implanted to provide a HALO implant area extending deeper than said first amorphous layer.

However, Wang and Keys do not specifically disclose that prior to said action b), an initial dopant is implanted to provide a HALO implant area extending deeper than said first amorphous layer.

Maszara teaches that prior to said action b), an initial dopant is implanted to provide a HALO implant area extending deeper than said first amorphous layer **(Col. 8, Ln. 33-45 and Col. 7, Ln. 11-32)**.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made, to provide a HALO implant area extending deeper than the first amorphous layer prior to making the first amorphous layer, as taught by Maszara, for

Art Unit: 2812

the purpose of eliminating diffusion of species and confining the species at a desired distance (**Col. 7, Ln. 26-32**).

6. Claim **8-10** are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (U.S. Patent Application Publication No. 2005/0054173) in view of Xiang (U.S. Patent No. 6,555,439).

8. Referring to claim **8**, Wang discloses a semiconductor device made by a solid phase epitaxial regrowth technique (**figs. 3 and 2E, [0031]**), comprising a semiconductor substrate (**200**) with a first area having a first conductivity profile (**212**) and a second area having a second conductivity profile (**218**), the first area having a thickness, the second area having a thickness located adjacent to a top surface of said semiconductor substrate (**200**), and said first area having being located adjacent to said second area, said second conductivity profile (**212, fig. 2C, [0027]**) having a lower conductivity than said first conductivity profile (**218, fig. 2D, [0029]**).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to disclose that the second area having a thickness that is 2 to 4 times the thickness of the first area, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233."

However, Wang does not specifically disclose that the first area has a thickness of 2-6 nm.

Xiang teaches a semiconductor device wherein the first area has a thickness of 2-6 nm (**fig. 2D, Col. 3, Ln. 29-37**).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made, to make the first area have a thickness of 2-6 nm, as taught by Xiang, and therefore make the second area have a thickness of 6-12 nm, for the purpose of speeding recrystallization and amorphization.

9. Referring to claim **9**, Wang and Xiang disclose a metal oxide semiconductor device comprising a device as claimed in claim 8 (**fig. 2D, [0003], Wang**).

10. Referring to claim **10**, Wang and Xiang disclose an apparatus provided with a semiconductor device as claimed in claim 8 (**fig. 2D, [0003], Wang**).

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to PAPE SENE whose telephone number is (571)270-5284. The examiner can normally be reached on 5/4/9.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Garber can be reached on (571)272-2194. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/P. S./  
Examiner, Art Unit 2812

/Charles D. Garber/

Supervisory Patent Examiner, Art Unit 2812